

PLANNING AND ENGINEERING

PURPOSE

The planning phase for AML projects is most important with respect to design and cost. It is during this phase that the closure method (temporary-->permanent), environmental remediation, and historic preservation are determined, and the budget set. Once the preliminary decisions are made, the nature and cost of the project are virtually predetermined.

The planning phase starts with the initial decision to remediate an AML site, and continues until receipt of the detailed design for construction. In most cases, the work beyond conceptual design will be done by others, for example contractors or the federally funded State AML programs. Nevertheless, park AML project managers must decide the conceptual outlines of a particular project, oversee performance of the work, and approve final project acceptance on behalf of NPS.

This section very briefly summarizes the planning process to provide park AML project managers the background for their oversight role. In addition, this section will be useful in developing a plan to coordinate with other agencies and procuring the engineering and construction services. Of the various types of engineering studies shown in Fig. 1, only preliminary and definitive design are described in detail. Conceptual design is described in Tabs V and VII. The other levels simply represent variations of content and purpose from the levels described below.

DESIGN CRITERIA

Development of design criteria begins at the time a project is first identified. The foundation of the criteria is a statement of functional requirements that the project must meet. These functional requirements are further developed, validated, and expanded during conceptual and preliminary design.

The design criteria document should provide the architect-engineer with the following information:

1. Define purpose and functional requirements of project.
 - a. Proposed mine closures, erosion and sedimentation control, revegetation, and historic preservation.
 - b. Include a general arrangement drawing.
2. Provide a general description.
 - a. Site location with map.

- b. Construction conditions, temporary access, fencing, work areas, disposal areas, and borrow areas.
 - c. Site preparations.
 - d. Existing utilities.
 - e. Special security, environmental, safety (including mine safety), and health needs.
- 3. Provide all design requirements to be applied to meet the needs of the project such as performance criteria, limits, constraints, capacities, quantities, and area allocations.
 - 4. Incorporate or reference construction specifications and guidelines.
 - a. NPS.
 - b. Applicable national and local building codes.
 - 5. Incorporate or reference environmental regulations and permit requirements.
 - 6. Define quality assurance measures.
 - 7. Provide the designer with the following additional documents:
 - a. Studies, reports, and conceptual designs.
 - b. Copies of sketches and drawings including site and location plans, topographic maps, and plan of existing utilities.
 - c. List of government furnished equipment, supplies, and computer programs available for use by designer.
 - d. List of required drawings, and their size and scale.
 - e. Copy of project management plan.
 - f. Information on the procurement of construction such as required contract clauses, type of specifications, and contents of bid packages.

Completeness of the design criteria is important; however, avoid citing superfluous codes and standards. Superfluous criteria violate a primary goal which is to narrow the criteria to only those applicable to a specific design effort.

Give designer leeway to exercise expertise in the engineering disciplines and to use up-to-date design and construction methods.

REQUEST-FOR-PROPOSALS

When the need arises to procure engineering or construction services, follow NPS guidelines and the Federal Acquisition Regulations. The contracting officer has the prime responsibility for soliciting contract services: however, the project manager must provide technical material. The following outline summarizes the technical information typically provided in a request-for-proposals (RFP).

TABLE I
OUTLINE OF TECHNICAL PART OF REQUEST-FOR-PROPOSALS

- | | |
|------|---|
| I. | Introduction |
| A. | Background and short history of project. |
| B. | Define project (what, where, when, why, who, how). |
| C. | Summarize need (level of engineering or construction). |
| II. | Scope of Work |
| A. | Define the objective functional requirements. |
| B. | Define the limits and content of the work. |
| C. | Summarize the primary design criteria. |
| D. | List available data and reports. |
| E. | Provide a broad work breakdown structure. |
| F. | Provide project milestones and expected deadlines. |
| G. | Describe services, equipment, and facilities provided by client. |
| III. | Client's Project Management |
| A. | Organization |
| B. | Responsibility and authority. |
| IV. | Recommend Outline of Contractor's Technical Proposal |
| A. | Statement of work by work breakdown structure and task. |
| B. | Project schedule. |
| C. | Cost estimate (define outline in order to compare proposals and evaluate technical adequacy). |
| D. | Statement of contractor's qualifications. |
| E. | Project management and resumes of professional staff. |

When deciding on who will perform design and construction work, consider the following factors:

1. Mine engineering and remediation expertise.

2. Availability, existing and projected work loads.
3. Size, complexity, and urgency of the project in regard to the candidate organizations qualifications and previous work experience.
4. Suitable professional and labor skills.
5. Adequate and appropriate construction equipment.

Some of the larger parks have substantial construction capabilities within their maintenance departments. The preceding factors also can be used to evaluate whether a particular maintenance department has the qualifications and availability to provide AML engineering and construction services.

CONCEPTUAL DESIGN

For an AML project, conceptual design is accomplished by completing the Site Reconnaissance Form in Tab VII and the cost estimate in Tab V.

PRELIMINARY DESIGN

The fundamental objectives of preliminary design are to satisfy the AML program objectives and the various statutory requirements while achieving minimum construction costs. The objectives that distinguish preliminary design from conceptual design include validation of technical adequacy and project feasibility; identification and quantification of any project risks; and estimation of reliable project costs and completion schedule. An outline of a typical preliminary design and cost report is given below.

These objectives are accomplished by developing the following (see also Fig. 1):

1. Requirements
 - a. Project scope, performance requirements, general project criteria, and design parameters including applicable codes and standards.
 - b. Statutory or other special requirements.
 - c. Health, safety, and security requirements.
 - d. Quality assurance requirements.
2. Design and Engineering

- a. Potential environmental damage and methods of remediation.
- b. Site development -- mine closures, erosion and sedimentation control, surface remediation, revegetation, historic preservation. Describe work breakdown structure and engineering methods. Include traceable backup details.
- c. Trade-off studies and alternative design approaches to optimize design and minimize costs.
- d. Types and materials of construction.
- e. Specifications of major equipment and long lead-time items.
- f. Drawings include layout and general arrangement. Generally, one line electrical, and piping and instrument drawings are also provided; however, these are not applicable to AML sites unless the project involves significant historic preservation.

3. Project Planning

- a. Estimate resource needs -- labor, equipment, and capital.
- b. Project schedule including engineering, procurement and construction. Special care must be placed on identifying long lead-time items and critical tasks.
- c. Identification and elimination of uncertainties.

4. Feasibility

- a. Estimate costs for the subsequent phases of design, engineering, and construction.
- b. Estimate construction labor, equipment, and material quantities. Major items of construction and equipment should be estimated from quantity take-offs while remainder may be estimated by factors.
- c. Provide contingency requirements and analysis.
- d. Describe cost estimating methodology and provide backup details.

TABLE II
OUTLINE OF PRELIMINARY DESIGN REPORT

I. Introduction

II. Project Overview

- A. Project Background and Justification
- B. General Site Description
- C. Mine Closure and Remediation Options

III. Selected Mine Closure and Site Remediation

- A. Mine Closure
- B. Surface Remediation
- C. Revegetation
- D. Material Requirements
- E. Equipment Requirements
- F. Labor Requirements

IV. Engineering and Construction Schedules

V. Cost Estimate

- A. Mobilization
- B. Excavation and Backfill
- C. Mine Closure
- D. Site Grading
- E. Erosion and Sedimentation Control
- F. Site Cleanup
- G. Revegetation
- H. Wildlife Restoration
- I. Risk Assessment and Contingency Allowance
- J. Detailed Engineering
- K. Construction Cost and Maintenance

Appendix: Technical Specifications

- 1. General
- 2. Mobilization
- 3. Mine Closure
- 4. Excavation and Backfill
- 5. Site Grading
- 6. Site Cleanup
- 7. Revegetation
- 8. Wildlife

Engineering Drawings

- D1 Site Location Map
- D2 Pre-Remediation Site Plan
- D3 Mine Closure Plan and Cross Sections
- D4 Post-Remediation Site Plan

Preliminary designs may be performed by State AML programs, NPS park or central engineering services, and architect-engineering firms. A typical preliminary design report has the content and organization shown in the above box.

DEFINITIVE DESIGN

The architect-engineer firm utilizes the client (NPS) approved preliminary design and any revised project design criteria as the base for definitive design. Completion of definitive design ends the design phase of a project, and normally allows the beginning of the construction phase. Definitive design includes:

1. Restudy and redesign work resulting from necessary changes identified by preliminary design.
2. Development of final working drawings and specifications for procurement and construction.
3. Plan for construction and methods of performance.
4. Schedules for build-up and phase-out of construction labor, equipment, and materials. Schedules must provide for items that require a long lead-time for procurement, and adequate time for administrative actions and permitting.
5. Identification of work packages and subcontracts.
6. Identification of all required permits and plan for permit applications.
7. Preparation of procurement plan.
8. Detailed estimates of the cost of construction. Estimates based on detailed quantity take-offs.
9. Design reviews by client. Client reviews typically occur after completing 30%, 60%, and 100% of design work.
10. Procedures for change control and client acceptance of work completed.
11. Quality assurance/quality control

As discussed above, many AML projects will not require detailed engineering design. If they do, generally it will be procured from engineering firms.

PROJECT RECORDS

A project record is maintained by the project manager, and typically contains the following documents:

1. All engineering plans.
2. Design criteria.
3. Management plan and changes thereto.
4. Selection plans for contractors.
5. Contracts.
6. Project authorization and all modifications.
7. All cost estimates.
8. Project reports.
9. Construction photographs (before, in-progress, and after).
10. Minutes of project meetings.
11. Construction completion, inspection, and acceptance reports.
12. As-built drawings.
13. Documentation required by NPS guidelines and Federal Acquisition Regulations.